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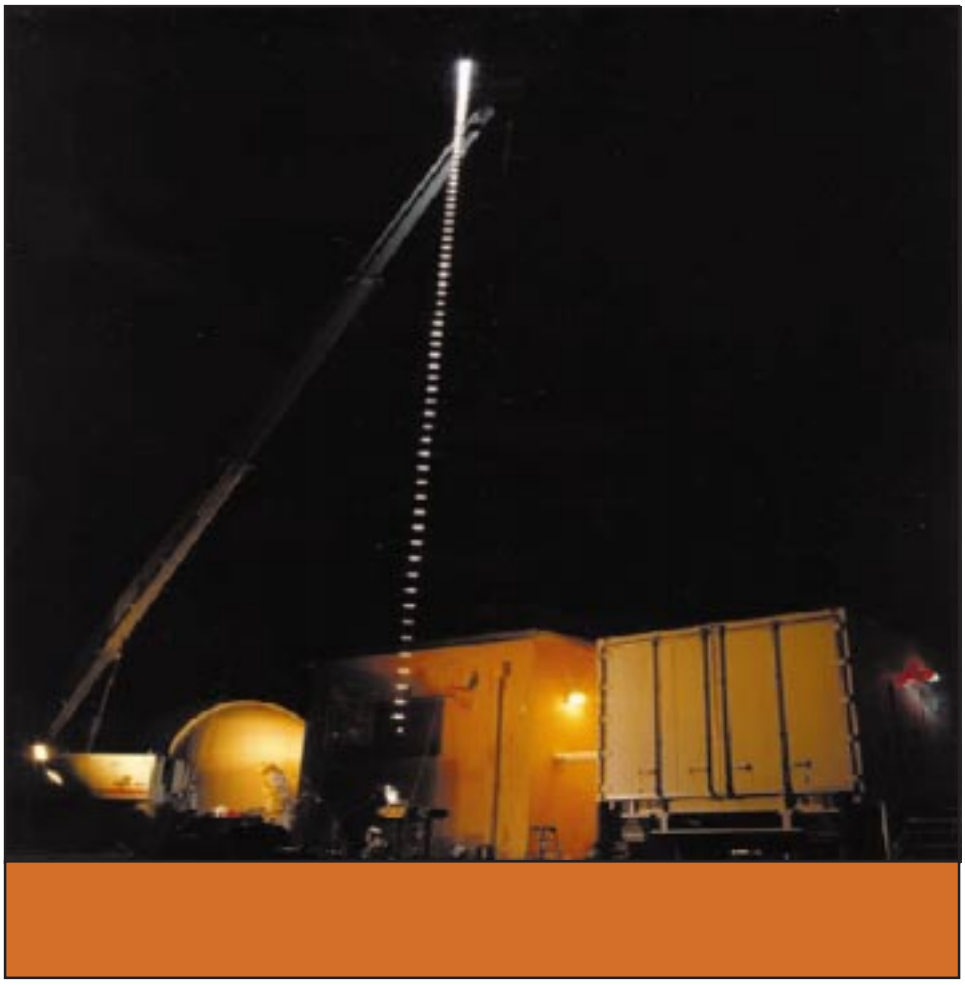
Success Story

LIGHTCRAFT PROPULSION TECHNOLOGY



The successful unconstrained flight test of the small scale Lightcraft vehicle demonstrates the feasibility of using high powered pulsed lasers to propel spacecraft into orbit. Preliminary flight tests reached an altitude of approximately 30 meters. This technology advance has the potential to reduce the cost of launching small payloads into space to less than $1000/kg.

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Accomplishment

In a joint program with NASA-Marshall Space Flight Center, the Propulsion Sciences and Advanced Concepts Division, Propulsion Directorate, developed and tested a unique experiment to determine the feasibility of using high powered, pulsed lasers to launch small payloads into orbit. The successful tests demonstrated the first passively controlled vertical free flight of an object propelled by a pulsed laser. A series of test flights at the White Sands Missile Range, High Energy Laser Systems Test Facility (HELSTF) have achieve an altitude of about 30 meters. This maximum altitude is currently limited only by the power and beam quality of the U. S. Army's 10 kW Pulsed Laser Vulnerability Test System (PLVTS) carbon dioxide laser.

Background

The Lightcraft Propulsion Technology is a potential method for launching small satellites into Low Earth Orbit for considerably less than current launch systems. This project grew out of the Lightcraft Technology Demonstration program funded by the Strategic Defense Initiative Organization (SDIO) Laser Propulsion Program in the late 1980's. The Lightcraft vehicles consist of an axisymmetric, off-axis parabolic collection mirror that concentrates the pulsed infrared laser light into an annular focus. The power of the 18 ms pulsed laser is sufficiently high that atmospheric breakdown occurs, producing a superheated plasma shock wave that propels the flight vehicle along in the direction of the laser beam. This concept has the advantage of using the ambient air as the working fluid in the atmosphere and carrying propellant only for use outside the atmosphere, leaving the energy source for heating the propellant on the ground. Current designs are limited to about 60 grams mass and 14 centimeters in diameter by the PLVTS laser used for propulsion. This laser also limits the flight altitudes to about 30 meters because of the divergence of the beam. A 150 kW pulsed carbon dioxide laser is being designed by Air Force and Industry researchers, with funding from NASA. Such a laser would provide the capability to reach vertical altitudes of up to 100 km and demonstrate the feasibility of this technology for low cost access to space.

Propulsion Directorate
Emerging Technologies

Additional information

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